In the Drawings

Please add the four new sheets of drawings submitted herewith.

REMARKS

After entry of the foregoing amendments, claims 1-39 are pending in the application.

Drawings have been submitted in accordance with the Examiner's requirement. However, drawings are not believed to be necessary for an understanding of the subject matter sought to be patented.

Corresponding amendments have been made to the specification, to refer to the new drawings.

No new matter has been added. Support for each feature illustrated in the drawings is found in the claims as originally filed.

Rejections Based on Kondo

Claims 1-4, 30 and 34-37 stand rejected as anticipated by Kondo (6,215,421).

Kondo is somewhat difficult to understand due to its manner of translation into English. However, it is basically understood to disclose a system for encoding a photograph so as to also convey, e.g., a text caption. A complementary decoder is able to discern the text caption, and is said to be able to return the photograph to its pre-encoded state.

In one embodiment, information is encoded by selectively interchanging data between horizontal lines in an image (e.g., switching lines 104 and 105, in Fig. 2). In another embodiment, information is encoded by selectively swapping data between different parts of an image frame, e.g., swapping elements 403 and 404 in Fig. 5A (resulting in the image shown in Fig. 5B).

To restore the image to its original form at the decoder, Kondo proposes "utilizing the deviation of continuity." He explains this by reference to the inserted waveform 302 in Fig. 4B – saying it can be removed by first noting the discontinuity, and then replacing this portion with a waveform having a variation pattern similar to the variation patterns at either side of this portion. See, e.g., col. 5, lines 23-50. He describes a similar approach to recover the original image of Fig. 5A (col. 6, lines 1-36).

Thus, restoration of the encoded image back to its original form is based on a correlation approach – the changed part of the image can be approximated by a nearby portion that is unchanged, and substituting such nearby portion for the changed portion tends to restore the image back towards its original state.

The restoration, however, is not necessarily perfect. It is an approximation – reliant on the self-similarity of neighboring portions of the image.

Kondo gives another example illustrated by Fig. 7. Here an image has been divided into blocks, e.g., of 4 x 4 pixels. If each pixel is represented by 8 bits, then there are 8 planes of pixels. The order of these 8 planes in a single block can be shuffled into 8! different orders (i.e., 40,320 different combinations). By shuffling the bit planes into one of these 40,320 different orders, a message payload of slightly over 15 binary bits can be represented. (15 bits can represent up to 32,768 states.) See, e.g., col. 9, lines 32-67.

If one such block is bit-plane-shuffled in an image, and the image is transmitted to a decoder, the decoder determines the order of bit plane shuffling in that block. It is understood to do this by knowledge that bits in the high order bit planes are likely closely correlated, while bits in the lower order bit planes are progressively less likely to be correlated. (E.g., the most significant bit of a pixel in a 4x4 block is likely to have the same value as every other pixel MSB in that block (i.e., high correlation), whereas the least significant bit of such a pixel is likely to be essentially uncorrelated with the LSBs of other pixels in the block.)

To restore the bit planes to their original order, the decoder assesses each 4x4 bit bit-plane for internal correlation, and re-orders them – with the most highly correlated 4x4 serving as the most significant bit-plane, and progressively less-correlated 4x4s comprising progressively less-significant bit planes. See, e.g., col. 11, lines 14-28 and 60-62.

To determine the correlation between bits in a single 4x4 bit plane, Kondo first transforms the 4x4 array into a 3x3 array (Fig. 11, e.g., taking the northwest-most 3x3 array). This 3x3 array has a central pixel, surrounded by eight edge pixels. He counts the number of edge pixels that share the same value (0 or 1) as the central pixel, and this number serves as the correlation value for this 3x3 bit bit-plane. He then repeats this process for the three other 3x3 arrays that can be excerpted from the original 4x4 array, and sums the results of all four

operations. This yields a number between 0 and 32, which serves as a correlation value for the 4x4 bit plane. (See col. 12, lines 1-21.)

He performs this operation on all eight bit-planes forming the block, and then re-shuffles their order (hopefully back to their original order) by rearranging in ascending order of correlation. (See col. 12, lines 22-36; Fig. 12.)

Again, however, it will be recognized that such restoration will often not be perfect. The correlation principle on which Kondo relies holds true on average, but in any particular block of 4 x 4 pixels, significant deviations from such average can be expected occasionally to occur. (E.g., the fifth-most-significant bit plane may not always have an internal correlation less then the fourth-most-significant bit plane; the sixth-most-significant bit plane may not always have an internal correlation less then the fifth-most-significant bit plane; etc, etc.)

To redress this, Kondo proposes evaluating candidate pixel blocks before shuffling their bit-plane orders. Blocks that don't meet the ascending correlation requirement are determined to be unfit, and are not used for embedding any message payload. (See col. 15, lines 1-21.)

(Kondo does not make clear how the decoder knows which blocks have been altered – and thus convey embedded information – and which have not been altered.)

Claim 1 requires compressing a first media signal, and embedding it into a second media signal. Kondo is not understood to teach any compression of a first media signal, and subsequent embedding of same into a second media signal.

Nonetheless, claim 1 has been rewritten to include the limitation of claim 2, which has been canceled.

Amended claim 1 is not anticipated by Kondo. He does not teach embedding a compressed first media signal into a second media signal, where the first media signal is at least a part of the second media signal. Instead, the information that Kondo teaches embedding into an image is, e.g., a description of the image, or a person's voice. (And no compression is taught.)

Nor does Kondo teach the limitation introduced by claim 3. (He teaches that the 40,320 different sort orders into which eight bit planes can be shuffled can represent a string of log2(8!) message bits (see col. 9, line 56); however, claim 3 requires more than this.)

Kondo does not teach the method of claim 30. The Action cites Kondo's Fig. 14 as teaching features of this claim. However, Kondo's Fig. 14 shows a decoding process, not the (earlier) embedding process defined by claim 30.

Moreover, the Action maps the claimed "regions" of claim 30 to Kondo's "bit-planes" (S13 in Fig. 14). But Kondo does not teach compressing a media signal from a first "bit-plane" region of a block, and embedding redundant instances of such compressed signal into a second ("bit-plane) region of two or more blocks.

Regarding claim 37, the permutations taught by Kondo relate to the 40,320 different ways that eight bit-planes can be ordered. He does not teach mapping redundant instances of the compressed media signal into different blocks according to a permutation.

Rejections Based on Bhaskaran

Claims 5-11 and 13-29 stand rejected as anticipated by Bhaskaran (6,064,764).

Bhaskaran's watermark W (with which a JPEG image may be encoded) is understood to comprise a k-bit hash value of the image, which is thereafter processed with a secret K and a digital signature algorithm.

Claim 5 requires that the auxiliary signal decoded from the host signal represent a compressed version of the host signal. Bhaskaran is not understood to teach this. However, the Office has apparently adopted the extreme view that any function that reduces a set of data is "a compressed version." To avoid such interpretation, applicants have amended claim 5 to further specify that the decompressed version is perceptually similar to the host signal. The hashing process taught by Bhaskaran (see, e.g., col. 2, line 63 – col. 3, line 34) does not meet this requirement.

Dependent claim 39 has been newly added, specifying that the decompression of claim 5 is a JPEG 2000 decompression process.

Bhaskaran at col. 5, lines 47-65 does not teach the limitation introduced by claim 6. (For information concerning the "sorting order" limitation of claim 6, see e.g., applicants' published specification at paragraphs 15, 16, 37, 39 and 43.) Accordingly, claim 6 has been rewritten into independent form – without the limitation newly added to claim 5.

Regarding claim 9, the Action asserts that Bhaskaran at col. 6, lines 45-67 teaches that the decoded blocks are used to authenticate host data. However, this is not what the claim states. Claim 9 requires that "auxiliary data decoded from one block of the host signal is used to authenticate another block of the host signal." Bhaskaran does not teach or suggest same. Accordingly, this claim has also been rewritten into independent form.

Independent claim 10 is likewise not anticipated by Bhaskaran. For example, Bhaskaran does not teach any lossless compression in the context claimed (nor does the Action address this aspect of the claim).

Lossless compression refers to compression that yields data from which the original blocks of the media contents can be perfectly restored. Bhaskaran, in contrast, teaches hashing – which is not lossless compression. Moreover, the JPEG compression with which Bhaskaran is concerned is lossy compression; not lossless. See in this regard, the attached Exhibit A1 which explains:

> JPEG is "lossy," meaning that the decompressed image isn't quite the same as the one you started with. (There are lossless image compression algorithms, but JPEG achieves much greater compression than is possible with lossless methods.) JPEG is designed to exploit known limitations of the human eye, notably the fact that small color changes are perceived less accurately than small changes in brightness. Thus, JPEG is intended for compressing images that will be looked at by humans. If you plan to machine-analyze your images, the small errors introduced by JPEG may be a problem for you, even if they are invisible to the eye.
>
> A useful property of JPEG is that the degree of lossiness can be varied by adjusting compression parameters. This means that the image maker can trade off file size against output image quality. You can make *extremely* small files if you don't mind poor quality; this is useful for applications such as indexing image archives. Conversely, if you aren't happy with the output quality at the default compression setting, you can jack up the quality until you are satisfied, and accept lesser compression.

1 From http://www.faqs.org/faqs/jpeg-faq/part1/ .

Regarding independent claim 17, the claim requires, e.g., that the watermark message signal includes information about a watermark embedder function. No such feature appears taught or suggested by Bhaskaran.

(Applicants' published specification discusses this "information about a watermark embedder function" at, e.g., paragraphs 10, 11, and 117 et seq.)

While claim 17 is addressed to an encoding method, independent claim 24 is directed to a related decoding method. Claim 24 requires that the watermark message include – in addition to the hash – "watermark embedding information used by the watermark embedding function." Again, no such feature is taught or suggested by Bhaskaran.

Likewise, independent claim 28 requires creation of a watermark difference signal that carries "information about a watermark embedder function used to embed the watermark message signal into the difference signal." Again, Bhaskaran does not teach or suggest same.

There are other comments and points of distinction that may be made concerning the art, the claims, and the rejections. However, the foregoing points are believed sufficient to establish that the claims are patentable over the art, so such further issues are not belabored.

Respectfully submitted,

DIGIMARC CORPORATION

By______________________

William Y. Conwell
Registration No. 31,943

Date: December 21, 2005

Customer Number 23735

Phone: 503-469-4800
FAX 503-469-4777